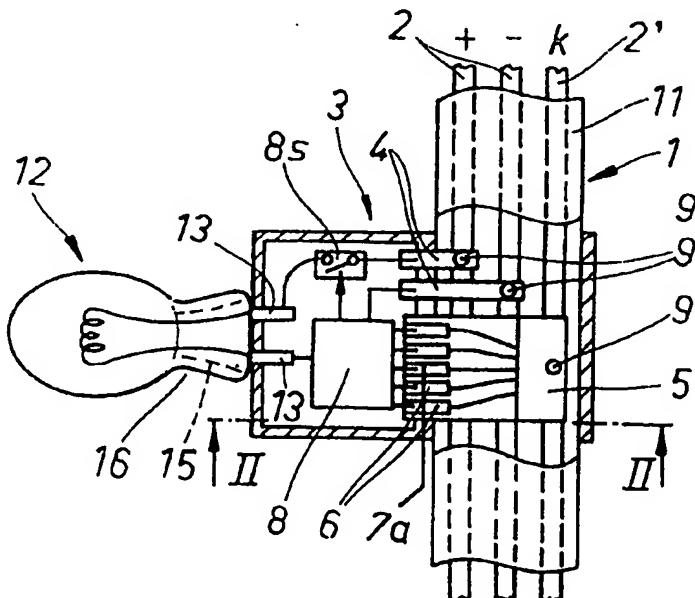




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: CONDUCTOR JOINT AND TOOL AND METHOD FOR MAKING THE JOINT



## (57) Abstract

The invention relates to a wire connector or a conductor joint used for making a galvanic joint with flat metal-strip conductors (2) surrounded by an insulating sheath (11) for the supply or delivery of electricity or for a joint between conductors required in the branching or extension of a wire. A connector (3) or a separate tool for making a joint is provided with sharp-pointed pins (9) which are capable of piercing the plastic sheath (11) and the conductors (2). The pins (9) included in the connector are provided with conductor strips (4; 5, 6) for the supply or delivery of electricity or associated with the corresponding connector pins (9) included in a branch wire (1a).

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Conductor joint and tool and method for making the joint

The present invention relates to a conductor joint, comprising a conductor or wire connector for providing a galvanic joint between the connector and flat metal-strip conductors surrounded by an insulating sheath. Such a conductor joint is used for the supply of electricity into a conductor or the delivery of electricity from a conductor or for a joint between conductors required in the branching or extension of a wire.

The invention relates also to a tool and a method for making a conductor joint.

A wire connector or a conductor joint of the invention is especially intended for use in a new type of electric harness included in vehicles, particularly in automobiles, for supplying power to signal lamps, headlights or other electrical equipment of a vehicle. However, the invention is not limited to any given application. Another exemplary application includes community lighting systems.

The electric harnesses of automobiles and vehicles in general have been traditionally designed in such a manner that separate wires extend to the service points like signal lamps and headlights through operating switches and fuses. All signal and warning lights are also provided with separate wires which extend between a power source transducer and a light source. A result of this is that the electric harnesses included in automobiles make up a labour-intensive and quite expensive element in an automobile. Another problem is the defect sensitivity of such electric harnesses, which is due to a large number of joints between conductors and various components as well as to the fact that the conductors have an enormous total length, causing a significant possibility of short circuits e.g. as a result of attrition. The locating of contact faults and short circuits

and the mending of defects in such electric harnesses is a tedious process.

International Patent application WO93/10591 discloses an 5 improved system, wherein the signal lamps and other such electrically operated items are connected in parallel to one or just a few wires, whose conductor is provided with a code for the controlled operation of lamps and other such actuators. The lamp or the lamp socket is provided with necessary 10 electronics for identifying an operation control code intended for a relevant lamp or some other actuator. This system is capable of substantially simplifying an automobile electric harness for essentially reduced total costs and susceptibility to defects.

15 An object of this invention is to provide a novel type of wire connector or conductor joint, which is especially suitable for use in the or a like wiring system disclosed in the cited Patent publication WO 93/10591 in a manner that 20 the contact faults can be practically eliminated from conductor joints.

A further object of the invention is to provide a wire 25 connector, whose internal coding can be used for assigning various functions to signal lamps, which are even identical to each other or different only in terms of power ranges.

These objects are achieved by the invention on the basis of the characterizing features set forth in the annexed claims.

30 The invention will now be described in more detail by means of exemplary embodiments with reference made to the accompanying drawings, in which

35 fig. 1 shows a wire connector of the invention in a cut-away view (one half of the housing is omitted) when

using the connector between a wire 1 and a lamp 12;

5 fig. 2 shows the wire connector of fig. 1 in a section along the line II-II in fig. 1;

fig. 3 shows an enlarged detail included in the connector of fig. 2 at a connector pin 9 extending through a conductor 2;

10 fig. 3A shows a sharpened point 10 included in the connector pin 9 and viewed in the direction of the pin;

15 figs. 4 and 4A illustrate alternative connector embodiments intended for wire branching operations;

fig. 4B shows the application of a connector of the invention in a disconnectable extension connector; and

20 fig. 5 shows a tool for using an alternative wire connector of the invention or for making a conductor joint.

A wire connector of the invention is intended for use in making a galvanic joint between flat metal-strip conductors 2, surrounded by an insulating sheath 11, and electrical actuators, such as a signal lamp 12. This type of connector is shown in figs. 1 and 2. Alternatively, the connector is used for making a galvanic joint between metal-strip conductors 2 included in two different wires 1 and 1a.

30 The connector may or may not include an intelligent component described in more detail hereinbelow.

35 In the illustrated case, the conductors 2 included in a wire 1 are connected to the + and - terminals of a power source and a conductor 2' serves as a code conductor for providing an identification code, on the basis of which the ON/OFF-

switching of a lamp 12 or some other actuator is effected. Naturally, the code and current may also travel in one and the same conductor and, thus, a separate code conductor is not necessary. The supply of current from the conductors 2 to the connector is effected by way of conductor strips 4. One conductor strip 4 is connected by way of a semiconductor switch 8s to one terminal 13 of the lamp 12. The other conductor strip 4 is connected by way of an electronic component 8 to the other lamp terminal 13'. The electronic component 8 is provided with necessary circuit elements for regulating the power passing through the lamp 12. In addition, the electronic component 8 provides the switch 8s with an ON/OFF-control whenever it recognizes an identification code, intended for a particular connector 3 and received from the code conductor 2' which can also be replaced by a current conductor. The code conductor 2' is connected to the electronic component 8 by means of a plurality of parallel-connected connecting strips 6. The conductor strips 6 can be optionally cut along a line 7a. Depending on which conductor strips 6 are cut, it is possible to have signal lamps 12, which are e.g. identical or just provided with a different power range, operate in a different manner for a given application, e.g. as a blinker, a taillight, a parking light, reverse light or the like. Thus, the coding performed by cutting the strips 6 is in correlation with the location of each lamp 12 and an intended application pertinent thereto. This coding can be effected e.g. with a sharp-pointed tool by "nailing". In view of this nailing, the connector housing includes a top housing section 3a (fig. 2) which is provided with necessary holes 7 or sharp-pointed pins are set ready in these holes. Most preferably, this nailing can be effected by using available multi-pointed tools, wherein the desired points can be extended to a cutting depth. In a tool, those pins provided with a cutting point can be shiftable in such a manner that, according to a desired coding, any pins can be shifted to or from a cutting position. With

such a tool, even identical conductor connectors 3 can be converted to match the intended application thereof.

5 The cutable coding strips 6 can be replaced with relays or switches, certain ones of which can be activated or inactivated previously such that the code is only able to pass through some of the parallel-connected relays or switches.

10 An essential feature regarding the operation and operating reliability of such a connector is to secure a trouble-free and long-sustained galvanic contact between the conductors 2, 2' and the conductor strips 4, 6. Therefore, the conductor strips 4 and 5 are provided with special connector pins 9, whose points are sharpened such that the plastic sheath 11 and conductors 2 of the wire 1 can be pierced while the top housing section 3a, which is fitted with said connecting strips 4, 5, 6, is turned or pressed into position against a bottom housing half 3b. The housing halves 3a and 3b can be fastened to each other e.g. by means of self-locking snap 20 fits.

25 Alternatively, it is possible to use a special tool (fig. 5) provided with perforating pins 9a, corresponding to the connector pins 9 but having slightly smaller diameters and used for making preliminary perforations in the conductors 2. Thus, the points of the actual connector pins 9 need not be sharpened for piercing. In the exemplary case of fig. 5, a pre-perforation tool 25 is fastened to a shaft 21 which is capable of pivoting around a link 22. A perforation tool 30 table 23 is provided with guides 24 for receiving a wire 1. The shaft 21 can be pressed downwards for making preliminary perforations in the conductors 2, whereby the connection of a wire can be effected with a lesser force with a structurally weaker connector, possibly containing electronic components. When the pins included in the actual connector are 35 shorter and round-tipped, there is no hazard for the pins to penetrate through the connector housing.

Neither need the connector be provided with a prefabricated housing but, instead, the connector area can be sealed hermetically with adhesive, resin or a like paste.

- 5 The tips of pins 9 or 9a (included in the connector or a separate tool) are designed as sharp points in view of providing an elongated cutting ridge 10 whose direction corresponds essentially to the longitudinal direction of the conductors. Thus, this direction is transversal relative to
- 10 the direction of rolling. In this context, the direction of rolling refers to the direction in which most of the deformation occurs as the conductor is rolled from round to flat. As the conductor is flattening, the deformation in lateral direction exceeds that occurring in the longitudinal direction.
- 15 Thus, the piercing of a conductor 2 proceeds in such a manner that in the mid-section of a conductor is first provided with an elongated incision having a length almost equal to the pin diameter, the conductor sections on either side of said incision turning downwards and pressing firmly
- 20 against the sides of the pin 9 (or 9a), as shown in fig.3. This produces between the pins 9 and the conductor 2 a contact with a large surface area and a continuous prestress. In order to provide a lip as smooth as possible, the cutting ridge 10 has a length which is slightly less
- 25 than the diameter of the pin 9 (or 9a). If the preliminary perforations are made by using the sharp-pointed pins 9a, the edges of a hole produced in the conductor 2 will have a matching shape and, thus, the contact is guaranteed both by the slightly larger diameter of the connector pins 9 and by
- 30 the elasticity of an insulating material which compresses the edges of a hole in the conductor 2 around the pin 9. Since the piercing pin 9a included in the tool is similar to the pin 9 shown in fig. 3, it has not been especially illustrated. It may be preferable that the pin 9 or 9a does not
- 35 pierce the insulating sheath on the other side of the conductor, whereby the joint will have fewer points to be sealed.

Extending from the lamp 12 are two pins 13 and 13' which are insertable in slots included in the wire connector 3. The connector housing 3 may be provided with a special socket element 14 for securing the lamp 12 along with its connector 5 in a fixing hole at the point of service. Extending from the socket element 14 or elsewhere from the connector housing 3 are flexible tongues 15 which take hold of the opposite sides of the lamp 12 at its reduced neck portion 16 for immobilizing the lamp 12 in the connector 3, which in the 10 illustrated case provides an intelligent fastening socket for the lamp 12. Instead of a lamp 12, the connector 3 can be fitted e.g. with a contact plug, including a conductor for transmitting an electrical contact to a lamp or an actuator located further away from the connector. Also the 15 intelligent connecting socket of a lamp can be located away from the connector 3.

In the exemplary embodiment of fig. 4, a connector of the invention is used in wire branching. A connector housing 3' 20 includes two sets of pins 9, which are connected to each other by means of conductors 17 included in the connector 3' as integral components. Between the housing halves said connector housing is provided with suitable receiving slots for a wire 1 to be branched and for a branch wire 1a. When 25 the housing halves (corresponding to housing halves 3a and 3b) are pressed against each other, the pins 9 penetrate through the flat conductors 2 and 2' for providing a permanent contact between the conductors included in wires 1 and 1a. Thus, this embodiment does not have an electronic component included in the connector 3' or a possibility of internal coding, as in the embodiment of figs. 1 and 2. However, 30 it is possible to build an intelligent component also in a connector used in wire branchings, as designated at 18 in fig. 4A. Thus, the wire branch 1a is only supplied with 35 electricity as determined by a control code.

Fig. 4B illustrates yet another embodiment for a connector of the invention. Here, the disconnectable wire joint comprises socket heads 19, 20, each of which is separately connected to a wire 1 by means of a connector 3'' of the  
5 invention.

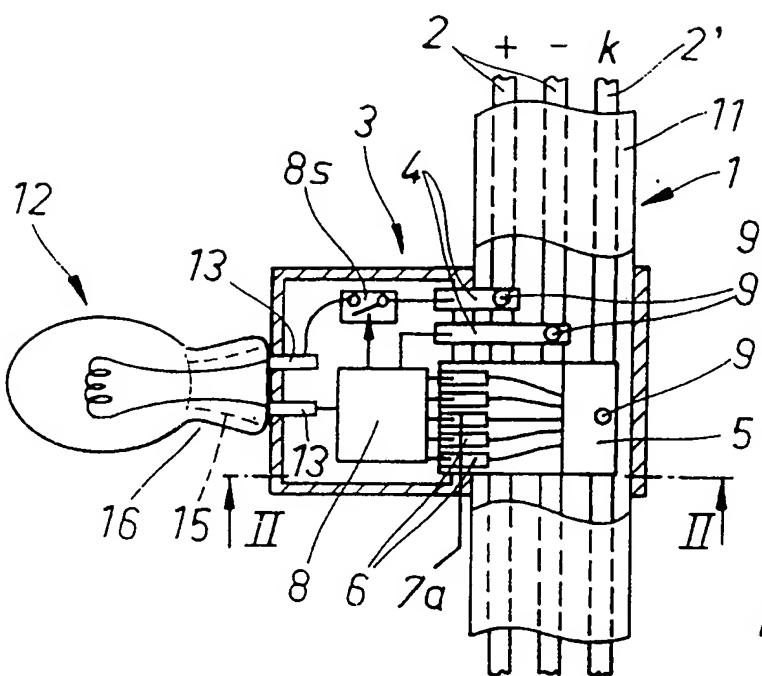
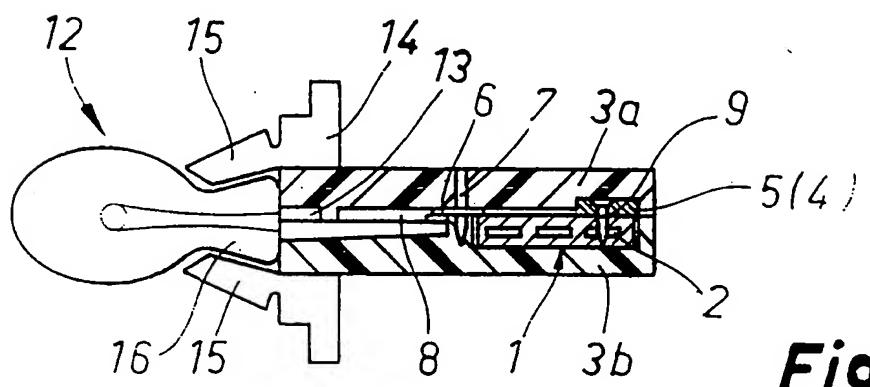
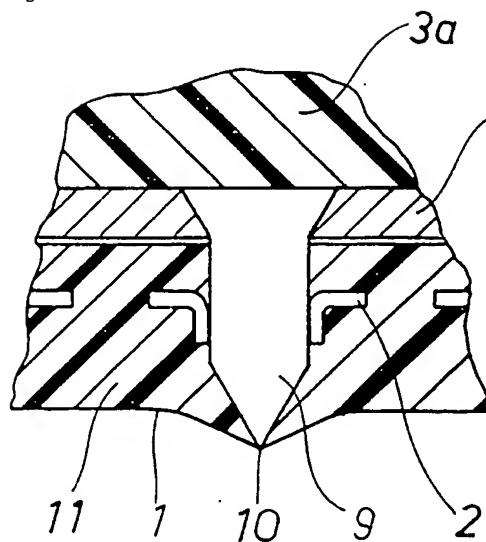
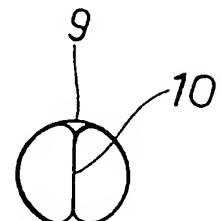
Claims

1. A conductor joint, comprising a wire connector (3) for providing a galvanic joint between the connector (3) and flat metal-strip conductors (2) surrounded by an insulating sheath (11), characterized in that the connector (3) is provided with one or a plurality of sharp-pointed pins (9) extending through the insulating sheath (11) and the conductor (2), and that the connector (3) is provided with a conductor strip (4; 5, 6) in contact with the pin (9) for the supply or delivery of electricity or in contact with a corresponding connector pin (9) included in a branch wire (1a).
- 15 2. A conductor joint, comprising a wire connector (3) for providing a galvanic joint between the connector (3) and flat metal-strip conductors (2) surrounded by an insulating sheath (11), characterized in that the connector (3) is provided with one or a plurality of pins (9) extending through the insulating sheath (11) and the conductor (2) by way of a preliminary hole made therein, and that the preliminary hole has a diameter which is slightly less than that of the pin (9).
- 25 3. A tool for making a conductor joint as set forth in claim 2, characterized in that said tool (25) includes a sharp-pointed pin (9a), which is pressable through the insulating sheath (11) and the conductor (2) and which pin (9a) has a diameter that is slightly smaller than the pin (9) included in the connector.
- 35 4. A method for making a preliminary hole in a conductor joint as set forth in claim 2, characterized in that the preliminary hole is made by means of the sharp-pointed pin (9a), which is pressed through the insulating sheath (11) and which pin (9a) has a diameter that is slightly smaller than the pin (9) included in the connector.

5. A conductor joint as set forth in claim 1 or a tool as set forth in claim 3, characterized in that the connector pin (9) or the pre-perforation pin (9a) has a point which is designed as a cutting ridge (10) having a  
5 length which is slightly less than the diameter of the pin (9, 9a).
10. 6. A conductor joint or a tool as set forth in claim 5, characterized in that the cutting ridge (10) extends in a direction which is substantially transversal to the direction of rolling of said conductor (2) to be pierced.
15. 7. A conductor joint as set forth in claim 1, 2 or 5, characterized in that at least one pin (9) is provided with a current path (6) which includes elements for the internal coding of the connector.
20. 8. A conductor joint as set forth in claim 7, characterized in that it is adapted to supply power to a signal lamp (12) or some other lamp or electrical actuator via an electronic component (8), such that the lamp or actuator is provided with an ON/OFF-switching which occurs in response to an identification code received from a conductor (2') included in a wire (1) to be connected and which is not dependent on said internal coding used for the determination of different functions for various lamps or actuators.
25. 30. 9. A conductor joint as set forth in claim 8, characterized in that said electronic component (8) and said connector (3) are provided with a common housing (3a, 3b).
35. 10. A conductor joint as set forth in any of claims 1, 2, 5-9, characterized in that said connector (3) is provided with at least three connecting pins (9), at

least one of which is for connecting the current wire (1) to the conductor (2) and at least one is for connecting the same to the code conductor (2') or to a combined current and code conductor.

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**Fig. 1****Fig. 2****Fig. 3****Fig. 3A**

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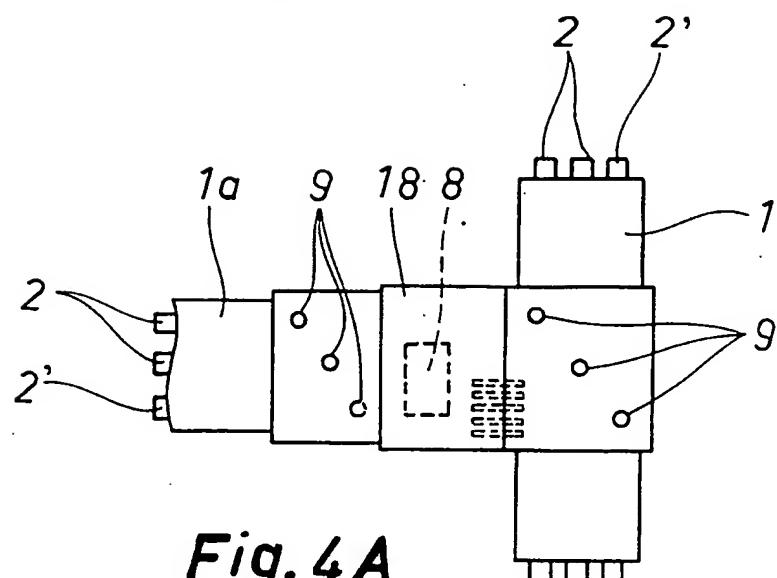


Fig. 4A

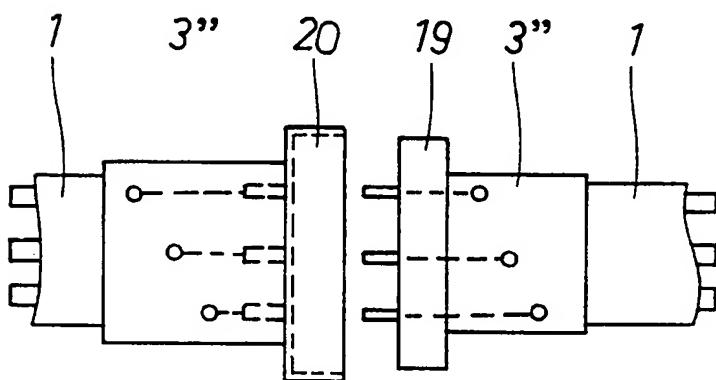


Fig. 4B

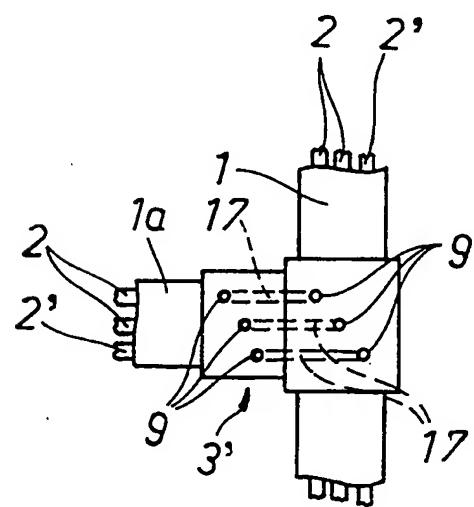
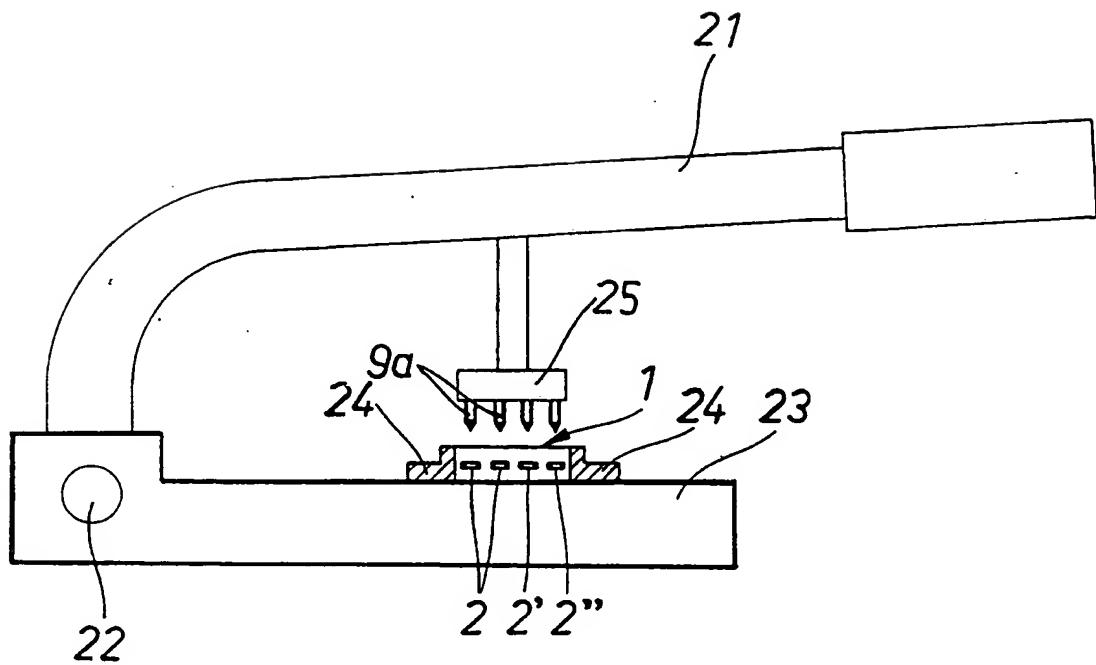


Fig. 4

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*Fig. 5*

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 94/00542

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H01R 9/07, H01R 4/24, H01R 43/28

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## WPI, CLAIMS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE, B1, 2507130 (H. AMACHER), 8 April 1976 (08.04.76), column 3, line 44 - line 54; column 4, line 19 - line 30; column 4, line 64 - line 67	1,2,5,6
Y	---	7-10
X	CH, A5, 662906 (B A G BRONZEWARENFABRIK AG TURGI), 30 October 1987 (30.10.87), abstract	1,2,5,6
Y	---	7-10
X	DE, A1, 2409311 (H. AMACHER), 12 December 1974 (12.12.74), page 2, line 10 - line 16	1,2,5,6
Y	---	7-10

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Date of the actual completion of the international search

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International application No.

PCT/FI 94/00542

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4259778 (THOMAS & BETTS CORPORATION), 7 April 1981 (07.04.81), column 3, line 59 - line 68, abstract	3-6
Y		7-10
A	--	2
X	WO, A1, 9312560 (S. KATONA), 24 June 1993 (24.06.93), page 2, line 5 - line 6, abstract	3-6
A	--	2
Y	WO, A1, 9310591 (H. KORKALA), 27 May 1993 (27.05.93), page 6, line 24 - page 7, line 21, figure 4, abstract	7-10
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## INTERNATIONAL SEARCH REPORT

Information on patent family members

09/02/95

International application No.

PCT/FI 94/00542

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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CH-A5- 662906	30/10/87	NONE		
DE-A1- 2409311	12/12/74	CH-A- DE-A,U-	569370 7406804	14/11/75 00/00/00
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WO-A1- 9312560	24/06/93	EP-A- HU-D- SE-B,C- SE-A-	0617850 9401729 470275 9103761	05/10/94 00/00/00 20/12/93 20/06/93
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